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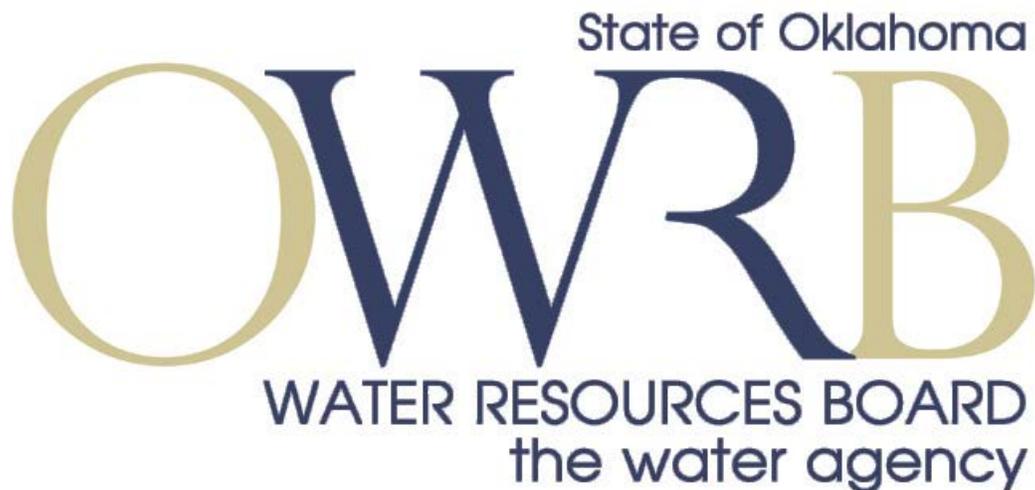
Rule Revisions to APPENDIX G

“NUMERICAL CRITERIA TO PROTECT BENEFICIAL USES”

JUSTIFICATION DOCUMENT

FOR

UPDATING THE HUMAN HEALTH CRITERIA



FY 2011 Triennial Revisions
to the
Oklahoma Water Quality Standards

September 14, 2012

JUSTIFICATION DOCUMENT

HUMAN HEALTH CRITERIA RECALCULATIONS FOR APPENDIX G, TABLE 2 “NUMERICAL CRITERIA TO PROTECT BENEFICIAL USES”

Introduction

Pursuant to section 304(a) of the Clean Water Act (CWA), EPA has published an updated compilation of its national recommended water quality criteria (NRWQC) for 158 pollutants. Information regarding these criteria updates was published in a **Federal Register** (FR) notice (65 FR 66443, 11/3/2000) announcing the availability of national recommended water quality criteria. The national recommended water quality criteria include: previously published criteria that are unchanged, criteria that have been recalculated from earlier criteria (63 FR68354, 12/10/1998) and newly calculated criteria based on peer-reviewed assessments and data. The EPA intends to revise this compilation of national recommended water quality criteria from time to time to keep States and authorized Tribes informed as to the most current recommended section 304(a) water quality criteria.

In 2000, the Environmental Protection Agency (EPA) revised its earlier 1980 human health methodology for calculating human health criteria (HHC). The new publication “Methodology for Deriving Ambient Water Quality Criteria for the Protection of Human Health (2000) made several changes that affected the formulas used in calculating the criteria. Two important changes included the use of bioaccumulation (BAFs) factors (where available) instead of bioconcentration factors (BCFs), an update in the freshwater/estuarine default fish consumption rate (FCR) or fish intake level (FI) from 6.5 g per day to 17.5 grams per day, as well as new cancer potency information from the Agency’s Integrated Risk Information System (IRIS).

In 2002, EPA updated its national 304(a) HHC recommendations for many pollutants using the new 2000 human health methodology. For each pollutant where criteria were updated in 2002, the “2002 Human Health Criteria Calculation Matrix” shows the input variables used in the new equations to derive the 304(a) criteria. There were 15 pollutants not included in EPA’s 2002 effort to update the national 304(a) HHC recommendations using the new 2000 methodology that were updated later in 2003.

The revision of these criteria represents a partial update, revising criteria for pollutants of high priority and national importance of the 304(a) criteria as described in the FR notice that accompanied the 2000 Human Health Methodology (65 FR 66443; November 3, 2000). EPA believes that updating a limited number of components for which there are available data or improved science (i.e., a partial update) is a reasonable and efficient means of publishing revised 304(a) criteria more frequently.

As EPA updates and revises its recommendations for HHC, all States and Tribes are required, under the Federal Clean Water Act, 303(c)(1), to periodically conduct a comprehensive review of their surface water quality standards (WQS) and modify, if appropriate. This is done as part of the Triennial Review.

After reviewing WQS revisions by OWRB in 2010, EPA presented a letter recommending the WQS section update additional human health water chemicals using EPA's 2000 Human Health Methodology and the new toxicological information (e.g. reference dose and cancer slope factors), as well as the new default fish consumption rate of 17.5 grams per day, in the absence of more local or regional fish consumption rate data. The following is a listing of those updated chemicals.

A. Changes to Human Health Criteria in APPENDIX G.

Justification for changes to APPENDIX G, Table 2. "Numerical Criteria to Protect Beneficial Uses and All Subcategories Thereof".

In 2010, the OWRB updated phenol and added acrolein as part of the WQS revision using the updated criteria based on EPA's Methodology for Deriving Ambient Water Quality Criteria for the Protection of Human Health (2000), EPA-822-B-00-004 (2000 Human Health Methodology). Based on EPA's request to update the States' HHC, the OWRB looked at 20 existing pollutants already listed in Appendix G, Table 2, and 5 new pollutants, and performed recalculations (see attached spreadsheet for carcinogens and noncarcinogens) for this 2012 Triennial Revision. These were chosen based on their priority pollutant status. The list of revised priority pollutants are shown here and are highlighted on Table 2, with their recalculated values in red. Fact sheets of individual chemicals are available on the OWRB website.

Carcinogens (16)

Acrylonitrile
Aldrine
Benzene
Carbon Tetrachloride
Chlordane
4,4'-DDD*
4,4'-DDT
Dichlorobromomethane
Dieldrin
2,3,7,8-TCDD (Dioxin)
Heptachlor
Hexachlorobenzene
PCB
Pentachlorophenol
Tetrachloroethylene (PCE)
Bis (2-ethylhexyl) Phthalate*

Noncarcinogens (9)

Butylbenzyl Phthalate
Diethyl Phthalate*
Dimethyl Phthalate*
Di-n-butyl Phthalate*
Endrin
Ethylbenzene
gamma-BHC (Lindane)
Thallium
Toluene

*New

The following are the USEPA (2000) formulas for calculating an ambient water quality criterion (AWQC) for human health protection for exposure to carcinogenic and noncarcinogenic substances through consumption of fish flesh (+ other organisms) and water and fish consumption (+ other organisms) only.

Ambient Water Quality Criteria equation based on cancer effects:

$$AWQC = RSD \cdot \left[\frac{BW}{DI + \sum_{i=2}^4 (FI_i \cdot BAF_i)} \right]$$

Ambient Water Quality Criteria equation based on noncancer effects:

$$AWQC = RfD \cdot RSC \cdot \left[\frac{BW}{DI + \sum_{i=2}^4 (FI_i \cdot BAF_i)} \right]$$

where:

- AWQC = Ambient Water Quality Criterion (mg/L)
- RfD = Reference dose for noncancer effects (mg/kg-day)
- RSC = relative source contribution
- RSD = Risk-specific dose for carcinogens
- BW = Human body weight (default 70kg or 150 lbs for adult)
- DI = Drinking water intake (2 L/day or 64 oz for adult)
(Note: for fish consumption (+ other organisms) only, the DI variable is removed)
- FI = Fish intake at trophic level (TL) of I (I=2, 3, and 4),
Total intake defaults to 0.0175 kg/day for general public, 0.1424 kg/day for subsistence fishermen
- BCF = Bioconcentration factor (L/kg)
- BAF = Bioaccumulation factor at trophic level I (I=2, 3, and 4), lipid normalized (L/kg)

B. Editorial or Non-Substantive Changes:

During the continuing usage and review of the Standards documents, small evolutionary changes are found that may be necessary to maintain the standards. Some changes may be necessary to comply with language found in new legislation. Some may simply be elimination of obscure or outdated language. Other changes may add language or definitions to make the Standards easier to interpret. In other cases, small scrivener and typographic errors have crept into the Standards document through the process of upgrading software or changing software platforms (e.g. Corel Word Perfect to Microsoft Word). The following are such changes:

1. The introductory paragraph to Appendix G is proposed to be modified to delete the words “cannot be exceeded”. This phrase is contrary and erroneous to text in the body of the OWQS. For example, this phrase is incorrect for human health parameters that are implemented as averages. Specific language regarding implementation of the criteria for each beneficial use can be found in the body of the OWQS or in Chapter 46.

Justification for changes to Preamble to APPENDIX G.

In 2001, OWRB staff sought to improve the utility of the OWQS by combining several lists of criteria protective of the various beneficial uses into a single table. This table has largely been seen as an improvement in the OWQS in providing convenient access to the criteria. The intent of the 2001 effort was only to move the criterion into the table and not to make any changes to the values or to their implementation. The preamble to Appendix G however, inadvertently contains language that could affect the implementation of the criteria for certain beneficial uses. In 2001 some of the language from raw water numerical criteria was used in the preamble stating that the criteria should not be exceeded.

PART 3. BENEFICIAL USES AND CRITERIA TO PROTECT USES

785:45-5-10. Public and private water supplies

The following criteria apply to surface waters of the state having the designated beneficial use of Public and Private Water Supplies:

- (1) **Raw water numerical criteria.** For surface water designated as public and private water supplies, the numerical criteria for substances identified under “Public and Private Water Supply (Raw Water)” column in Table 2 of Appendix G of this Chapter **shall not be exceeded**. Raw water numerical criteria are considered long term average standards. For purposes of permitting discharges for attainment of these standards, the permitting authority shall use long term average receiving stream flows and complete mixing of effluent and receiving water to determine appropriate permit limits.

This creates a conflict in the implementation of criteria for protection of other beneficial uses in the text of the OWQS where the criteria are implemented as averages or are allowed to exceed criteria within the mixing zone. Staff seek to eliminate this potential conflict by removing "*that cannot be exceeded*" from the preamble.

APPENDIX G. NUMERICAL CRITERIA TO PROTECT BENEFICIAL USES [NEW]

- (a) **Introduction.** This Appendix prescribes numerical limits for certain criteria which are necessary to protect beneficial uses as and wherever designated. Table 1 is a chart that states the numerical limits to protect the beneficial use and subcategories of Fish and Wildlife Propagation for the single parameter of dissolved oxygen as set forth in OAC 785:45-5-12(f)(1). The latter limits vary depending upon several factors including the pertinent subcategory or fishery class, the time of the year, and the seasonal temperature. Table 2 prescribes the numerical limits ~~that cannot be exceeded~~ for certain substances or parameters in order to protect beneficial uses and subcategories as set forth in OAC 785:45-5-10(1), 785:45-5-10(6), 785:45-5-12(f)(6), and 785:45-5-20. The numerical limits may vary from one beneficial use or subcategory to another according to how the criteria are required by OAC 785:45 or OAC 785:46 to be implemented. Table 3 is a chart that sets forth conversion factors that can be used to determine criteria for dissolved metals in order to protect the beneficial use of Fish and Wildlife Propagation and all its subcategories as set forth in OAC 785:45-5-12(f)(6)(H).
2. Table 2, "Numerical Criteria to Protect Beneficial Uses and All Subcategories Thereof", is proposed to be modified to delete mg/L units in the PPWS (Raw Water) column and replace with µg/L for consistency and uniformity with existing units used throughout Table 2.
 3. Table 2, "Numerical Criteria to Protect Beneficial Uses and All Subcategories Thereof", is proposed to be modified to add (+ Other Organisms) to both "Fish Consumption and Water" and "Fish Consumption" column headings, for clarity and consistency with the National CWA 304(a) Recommended Water Quality Human Health Criteria Table. This language reflects exposure of contaminants as a broader term that includes "shellfish," consistent with CWA §101(a)(2) which includes "fish, shellfish, and wildlife."

The "organisms" language (as opposed to fish) has been in use by EPA since at least the 1980 criteria documents/1980 HH methodology. The 2000 HH methodology characterizes "organisms" as aquatic organisms that are commonly consumed in the United States including finfish and shellfish. It appears that EPA uses the term "organisms" because it is a broader term that includes "shellfish," consistent with CWA §101(a)(2) which includes "fish, shellfish, and wildlife."

To get a better sense of what types of organisms this covers, it's helpful to look further at what goes into determining the FCR variable included in the human health equations. EPA's

national default FCR recommendation of 17.5 g/day for the general U.S. adult population comes from data collected as part of USDA's "1994-96 Continuing Survey of Food Intake by Individuals (CSFII)." As summarized in the 2000 Human Health Methodology, this survey "collects dietary intake information from nationally representative samples of non-institutionalized persons residing in United States households." EPA's national default of 17.5 g/day represents the 90th percentile of this data collected from adults (age 18 and older) and looking only at freshwater and estuarine finfish and shellfish. Note that the 90th percentile is calculated from a dataset that considered those who consumed fish/shellfish and those who did not. (In other words, those who consumed 0 g/day are included in the dataset as well as those who consumed some amount of fish/shellfish.)

EPA has a 2002 report titled "Estimated Per Capita Fish Consumption in the United States" which presents per capita estimates of daily average fish consumption based on quantities of consumed food reported by participants in the combined USDA 1994-1996 and 1998 Continuing Survey of Food Intakes by Individuals (CSFII). Even though this 2002 report looked at the 1994-1996 and 1998 USDA CSFII survey results, the table on page 5-6 of the report shows essentially the same FCRs as presented in EPA's 2000 HH methodology. See report at the following link:

http://water.epa.gov/scitech/swguidance/standards/criteria/health/upload/consumption_report.pdf. Appendix A of the report shows the species that were considered in the CSFII survey that serves as the basis for EPA's national default FCR, which include not only finfish but also organisms like crabs, clams, eels, mussels, lobster, shrimp, etc.

4. Updated calculations have been rounded to "two significant figures" (using 5 places as a cutoff point) also for consistency with EPA's 304(a) HH criteria.

C. ECONOMIC CONSIDERATIONS

The Oklahoma Department of Environmental Quality (ODEQ) reported that there are four permits, held by four facilities, which indicate exceedences of the national recommended water quality criteria (NRWQC) guidelines for Bis (2-ethylhexyl) Phthalate and 4,4'-DDD and which could potentially be affected by a change in the criteria for the listed revised priority pollutants. The actual costs for compliance with these proposed new criterion are unknown at this time. It would be expected to potentially impact facilities that use or discharge any of these chemicals.

APPENDIX G. NUMERICAL CRITERIA TO PROTECT BENEFICIAL USES

(a) **Introduction.** This Appendix prescribes numerical limits for certain criteria which are necessary to protect beneficial uses as and wherever designated. Table 1 is a chart that states the numerical limits to protect the beneficial use and subcategories of Fish and Wildlife Propagation for the single parameter of dissolved oxygen as set forth in OAC 785:45-5-12(f)(1). The latter limits vary depending upon several factors including the pertinent subcategory or fishery class, the time of the year, and the seasonal temperature. Table 2 prescribes the numerical limits ~~that cannot be exceeded~~ for certain substances or parameters in order to protect beneficial uses and subcategories as set forth in OAC 785:45-5-10(1), 785:45-5-10(6), 785:45-5-12(f)(6), and 785:45-5-20. The numerical limits may vary from one beneficial use or subcategory to another according to how the criteria are required by OAC 785:45 or OAC 785:46 to be implemented. Table 3 is a chart that sets forth conversion factors that can be used to determine criteria for dissolved metals in order to protect the beneficial use of Fish and Wildlife Propagation and all its subcategories as set forth in OAC 785:45-5-12(f)(6)(H).

(b) **Explanations for abbreviations and certain terms in Tables.**

- (1) "CAS #" refers to a parameter's Chemical Abstract Service registry number. Each of these numbers is a unique identifier of a particular compound with a particular structure; the number provides additional and further specificity for the parameter in question than simply identifying it by a systematic, generic, proprietary, or [trivial] name. The CAS number has no particular chemical significance.
- (2) Equations are prescribed for those substances the toxicity of which varies with water chemistry.
- (3) Metals that are listed in Tables 2 and 3 shall be measured as total metals in the water column.

TABLE 2.
Numerical Criteria to Protect Beneficial Uses and All Subcategories Thereof

PARAMETER	CAS #	Fish & Wildlife Propagation		Public & Private Water Supply (Raw Water)	Fish Consumption (+ Other Organisms) and Water	Fish Consumption (+ Other Organisms)
		ACUTE	CHRONIC			
		µg/L	µg/L	mg/L(X1000)	µg/L	µg/L
INORGANICS				µg/L		
Arsenic	7440382	360.0	190	40		205.0
Barium	7440393			1000		
Cadmium	7440439	e(1.128[ln(hardness)] -1.6774)	e(0.7852[ln(hardness)] -3.490)	20	14.49	84.13
Cadmium for trout streams		e(1.128[ln(hardness)] -3.828)	e(0.7852[ln(hardness)] -3.490)	20	14.49	84.13
Chromium (total)			50	50	166.3	3365.0
Copper	7440508	e(0.9422[ln(hardness)] -1.3844)	e(0.8545[ln(hardness)] -1.386)	1000		
Cyanide	57125	45.93	10.72	200		
Fluoride @ 90° F				4000		
Lead	7439921	e(1.273[ln(hardness)] -1.460)	e(1.273[ln(hardness)] -4.705)	100	5.0	25.0
Mercury	7439976	2.4	1.302	2	0.050	0.051
Nickel	7440020	e(0.8460[ln(hardness)] +3.3612)	e(0.846[ln(hardness)] +1.1645)		607.2	4583.0
Nitrates (as N)	14797558			10,000		
Selenium	7782492	20.0	5	10		
Silver	7440224	e(1.72[ln(hardness)] -6.52)		50	104.8	64620.0
Thallium	7440280	1400.0			1.7	0.24
Zinc	7440666	e(0.8473[ln(hardness)] +0.8604)	e(0.8473[ln(hardness)] +0.7614)	5000		
ORGANICS						
1-1-1 TCE	71556				3094.0	173100.0
2-4-5-TP Silvex	93721		10.0	10		
2-4-6-TNT		450.0				
2-4-D	94757			100		

PARAMETER	CAS #	Fish & Wildlife Propagation		Public & Private Water Supply (Raw Water)	Fish Consumption (+ Other Organisms) and Water	Fish Consumption (+ Other Organisms)		
		ACUTE	CHRONIC					
		µg/L	µg/L				mg/L (X1000)	µg/L
				µg/L				
Acrolein	107028				6.0	9.0		
Acrylonitrile	107131	7550.0			59 0.51	6.7 2.5		
Aldrin	309002	3.0			0.001273	0.00049	0.001356	0.00050
Benzene	71432		2200.0		11.87	22	714.4	510
Benzidine	92875			1				
Butylbenzyl Phthalate	85687			150				
Carbon Tetrachloride	56235				2.538	2.3	44.18	16
Chlordane	57749	2.4	0.17		0.00575	0.0080	0.00587	0.0081
Chloroform	67663					56.69		4708.0
Chlorpyrifos (Dursban)	2921882	0.083	0.041					
4,4'-DDD	72548					0.0031		0.0031
4,4'-DDT	50293	1.1	0.001		0.005876	0.0022	0.0059	0.0022
Demeton	8065483		0.1					
Detergents (total)				200				
Diazinon	333415	0.17						
Dichlorobromomethane	75274				4.9	5.5	457.0	170
Dieldrin	60571	2.5	0.0019		0.001352	0.00052	0.00144	0.00054
Dioxin (TCDD)	1746016				0.00000013	5.0E-08	0.000000138	5.1E-08
Endosulfan		0.22	0.056					
Endrin	72208	0.18	0.0023	0.2	.7553	0.059	0.814	0.060
Ethylbenzene	100414				3120.0	530	28720.	2100
Guthion	86500		0.01					
gamma BHC (Lindane)	58899	2.0	0.08	4	.1458	0.98	0.4908	1.8
Heptachlor	76448	0.52	0.0038		0.00208	0.00079	0.00214	0.00079
Hexachlorobenzene	118741				0.009026	0.0028	0.009346	0.0029
Malathion	121755		0.10					

PARAMETER	CAS #	Fish & Wildlife Propagation		Public & Private Water Supply (Raw Water) mg/L (X1000) µg/L	Fish Consumption (+ Other Organisms) and Water		Fish Consumption (+ Other Organisms)	
		ACUTE µg/L	CHRONIC µg/L		µg/L		µg/L	
Methoxychlor	72435		0.03	100				
Methylene blue active substances			0.001	500				
Mirex	2385855		0.001					
Nonylphenol	25154523	28	6.6					
Parathion	56382	0.065	0.013					
PCB			0.044		0.00079	0.00064	0.00079	0.00064
PCE (Tetrachloroethylene)	127184	5280.0			8.0	6.9	88.5	33
Pentachlorophenol	87865	e[1.005(pH)-4.830]	e[1.005(pH)-5.290]		1014.0	2.7	29370.0	30
Perchlorate	7601-90-3	6600	1800			9		
Phenol	108952					10,000.0		860,000.0
Phthalate esters				3				
Bis(2-ethylhexyl) phthalate (BEHP)	117817					12		22
Butylbenzyl phthalate	85687			150		1500		1900
Diethyl phthalate	84662					17000		44000
Dimethyl phthalate	131113					2.7E+05		1.1E+06
Di-n-Butyl phthalate	84742					2000		4500
RDX	121824	2591.5						
Toluene	108883		875.0		10150.0	1300	301900.0	15000
Toxaphene	8001352	0.78	0.0002	5				

Carcinogens Spreadsheet

Simplified Version of the "Water + Organism" Human Health Equation for Carcinogens
 Note: for "Organism Only" equation, remove "DI" variable

$$AWQC = \frac{(Risk\ Level \bullet BW)}{[CSF \bullet (DI + (FCR \bullet BAF))]}$$

where:

- AWQC = Ambient Water Quality Criterion (milligrams per liter)
- Risk Level = Risk level (unitless)
- CSF = Cancer slope factor (milligrams per kilogram per day)
- BW = Human body weight (kilograms)
- DI = Drinking water intake (liters per day)
- FCF = Fish Consumption Rate (kilograms per day)
- BAF = Bioaccumulation factor (liters per kilogram)

Table Showing Calculation of the "Water + Organism" and "Organism Only" Human Health Criteria for Carcinogens
 Note: Where a BAF is not available, use a bioconcentration factor (BCR) in place of the BAF
 Note: EPA's National 304(a) Criteria Recommendations Use a Risk Level of 10-6 (as opposed to 10-5 in Oklahoma)
 Note: EPA's National 304(a) Criteria Recommendations are Rounded to 2 Significant Figures

Pollutant	Risk Level	Body Weight (BW) (kg)	Cancer Slope Factor (CSF) or α^{**} (mg/kg/day)	Drinking Water Intake (DI) (L/day)	Bioconcentration Factor (BCF) (L/kg)	Fish Consumption Rate (FCR) (kg/day)	Risk Level x BW	BCF x FCR	DI+(BCF x FCR)	CSF x [DI+(BCFxFCR)]	CSF x (BCFxFCR)	Water + Org Criterion (ug/L)	Values rounded to 2 significant figures	Org Only Criterion (ug/L)	Values rounded to 2 significant figures
Dieldin Example Using 10-5 Risk Level and 17.5 g/d Fish Consumption Rate	0.00001	70	16.00	2	4670	0.0175	0.0007	81.725	83.725	1339.6	1307.6	0.000522544		0.000535332	
Acrylonitrile	0.00001	70	0.54	2	30	0.0175	0.0007	0.525	2.525	1.3635	0.2835	0.513384672	0.51	2.469135802	2.5
Aldrin	0.00001	70	17.00	2	4670	0.0175	0.0007	81.73	83.725	1423.325	1389.325	0.000491806	0.00049	0.000503842	0.00050
Benzene	0.00001	70	0.0152	2	5.2	0.0175	0.0007	0.091	2.091	0.0317832	0.0013832	22.024214050	22	506.072874494	510
Carbon Tetrachloride	0.00001	70	0.13	2	18.75	0.0175	0.0007	0.328	2.328125	0.30265625	0.0426563	2.312854930	2.3	16.410256410	16
Chlordane	0.00001	70	0.35	2	14100	0.0175	0.0007	246.8	248.75	87.0625	86.3625	0.008040201	0.0080	0.008105370	0.0081
4,4'-DDT	0.00001	70	0.34	2	53600	0.0175	0.0007	938	940	319.6	318.92	0.002190238	0.0022	0.002194908	0.0022
2,3,7,8-TCDD (Dioxin)	0.00001	70	156000	2	5000	0.0175	0.0007	87.5	89.5	13962000	13650000	0.000000050	5.0E-08	0.000000051	5.1E-08
Dichlorobromomethane	0.00001	70	0.062	2	3.75	0.0175	0.0007	0.066	2.065625	0.12806875	0.0040688	5.465814260	5.5	172.043010753	170
Dieldrin	0.00001	70	16	2	4670	0.0175	0.0007	81.73	83.725	1339.6	1307.6	0.000522544	0.00052	0.000535332	0.00054
Heptachlor	0.00001	70	4.5	2	11200	0.0175	0.0007	196	198	891	882	0.000785634	0.00079	0.000793651	0.00079
Hexachlorobenzene	0.00001	70	1.6	2	8690	0.0175	0.0007	152.1	154.075	246.52	243.32	0.002839526	0.0028	0.002876870	0.0029
PCBs	0.00001	70	2	2	31200	0.0175	0.0007	546	548	1096	1092	0.000638686	0.00064	0.000641026	0.00064
Pentachlorophenol	0.00001	70	0.12	2	11	0.0175	0.0007	0.193	2.1925	0.2631	0.0231	2.660585329	2.7	30.303030303	30
Tetrachloroethylene (PCE)	0.00001	70	0.039776	2	30.6	0.0175	0.0007	0.536	2.5355	0.100852048	0.0213	6.940860537	6.9	32.863775706	33
New Additions Requested by ODEQ															
Bis(2-ethylhexyl) Phthalate	0.00001	70	0.014	2	130	0.0175	0.0007	2.275	4.275	0.05985	0.03185	11.695906433	12	21.978021978	22
4,4'-DDD	0.00001	70	0.24	2	53600	0.0175	0.0007	938	940	225.6	225.12	0.003102837	0.0031	0.003109453	0.0031

Non-Carcinogens Spreadsheet

Simplified Version of the "Water + Organism" Human Health Equation for Non-Carcinogens

Note: for "Organism Only" equation, remove "DI" variable

$$AWQC = RfD \cdot RSC \cdot \frac{(BW)}{[DI + (FCR \cdot BAF)]}$$

where:

AWQC	=	Ambient Water Quality Criterion (milligrams per liter)
RfD	=	Reference dose for noncancer effects (milligrams per kilogram per day)
RSC	=	Relative source contribution factor to account for non-water sources of exposure (unitless)
BW	=	Human body weight (kilograms)
DI	=	Drinking water intake (liters per day)
FCR	=	Fish Consumption Rate (kilograms per day)
BAF	=	Bioaccumulation factor (liters per kilogram)

Table Showing Calculation of the "Water + Organism" and "Organism Only" Human Health Criteria for Non-Carcinogens

Note: Where a BAF is not available, use a bioconcentration factor (BCF) in place of the BAF

Note: Where an RSC is Not Provided in EPA Guidance, the Default is 100% (i.e., 1)

Note: EPA's National 304(a) Criteria Recommendations are Rounded to 2 Significant Figures

Pollutant	Reference Dose (RfD) (mg/kg/day)	Relative Source Contribution (RSC)*See above	Body Weight (BW) (kg)	Drinking Water Intake (DI) (L/day)	Bioconcentration Factor (BCF) (L/kg)	Fish Consumption Rate (FCR) (kg/day)	RfD x RSC	BCF x FCR	DI+(BCF x FCR)	BW / [DI+(BCFxFCR)]	BW / (BCFxFCR)	Water + Org Criterion (ug/L)	Values rounded to 2 significant figures	Org Only Criterion (ug/L)	Values rounded to 2 significant figures
Chlorobenzene Example Using 17.5 g/d Fish Consumption Rate	0.02	0.2	70	2	10.3	0.0175	0.004	0.18025	2.18025	32.10640982	388.349515	128.425639262		1553.398058252	
Butylbenzyl Phthalate	0.2	1	70	2	414	0.0175	0.2	7.245	9.245	7.571660357	9.6618357	1514.332071390	1500	1932.367149758	1900
Diethyl Phthalate	0.8	1	70	2	73	0.0175	0.8	1.2775	3.2775	21.35774218	54.794521	17086.193745233	17000	43835.616438356	44000
Dimethyl Phthalate	10	1	70	2	36	0.0175	10	0.63	2.63	26.61596958	111.11111	266159.695817491	2.7E+05	1111111.111111110	1.1E+06
Di-n-butyl Phthalate	0.1	1	70	2	89	0.0175	0.1	1.5575	3.5575	19.67673928	44.94382	1967.673928320	2000	4494.382022472	4500
Endrin	0.0003	0.2	70	2	3970	0.0175	0.00006	69.475	71.475	0.979363414	1.0075567	0.058761805	0.059	0.060453401	0.060
Ethylbenzene	0.1	0.2	70	2	37.5	0.0175	0.02	0.65625	2.65625	26.35294118	106.66667	527.058823529	530	2133.333333333	2100
gamma-BHC (Lindane)	0.0003	0.2	70	2	130	0.0175	0.00006	2.275	4.275	16.37426901	30.769231	0.982456140	0.98	1.846153846	1.8
Thallium	0.000068	0.2	70	2	116	0.0175	0.0000136	2.03	4.03	17.36972705	34.482759	0.236228288	0.24	0.468965517	0.47
Toluene	0.2	0.2	70	2	10.7	0.0175	0.04	0.18725	2.18725	32.00365756	373.83178	1280.146302435	1300	14953.271028037	15000